

## Microcapillary Recuperative Heat Exchanger (MRHX), Phase I

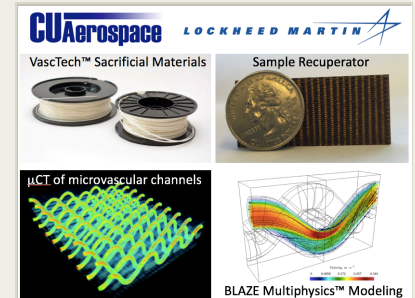
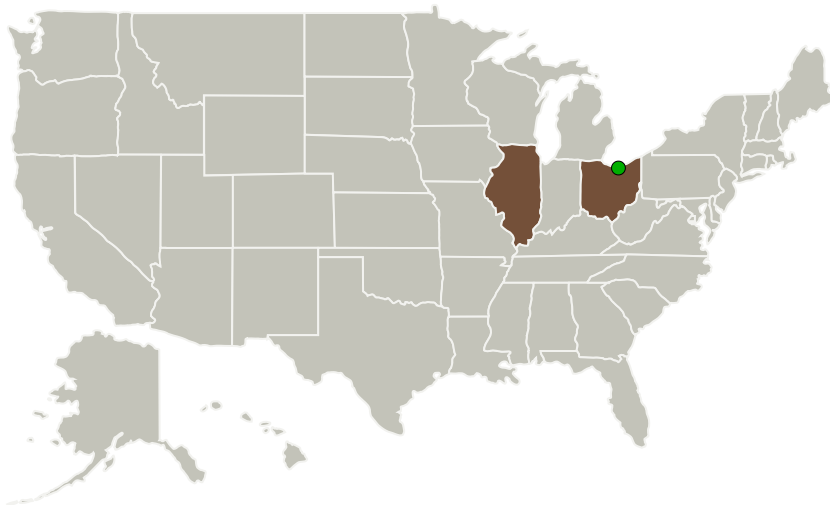
Completed Technology Project (2016 - 2016)



## Project Introduction

CU Aerospace (CUA) and team partner Lockheed Martin Space Systems Company (LMSSC) propose to develop a low-cost lightweight recuperative heat exchanger for High Power/High Efficiency cryocoolers, in support of Cryogenic Fluid Management for In-Space Transportation. Brayton cryocoolers are well suited for high cooling power space applications, especially those such as cryogenic propellant management that benefit from broad area cooling. However, Brayton recuperators are large, heavy and expensive. CUA and LMSSC have been developing a robust ultra-compact recuperative heat exchanger for Joule-Thomson (JT) cryocoolers using CUA's sacrificial fiber technology (VascTech). This technology relies on weaving warp sacrificial fibers with weft copper wires to make a 3D structure with excellent counterflow heat exchange, but low parasitic heat conductance. The proposed microcapillary recuperative heat exchanger (MRHX) requires much larger gas flow (for >150 W cooling at 90 K) than the JT recuperator, and the focus of this proposed work will be modifying and scaling up the heat exchanger for Brayton applications. This new recuperator material will reduce the mass and cost of Brayton coolers while offering improved thermal performance.

## Primary U.S. Work Locations and Key Partners



Microcapillary Recuperative Heat Exchanger (MRHX), Phase I

## Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

## Microcapillary Recuperative Heat Exchanger (MRHX), Phase I

Completed Technology Project (2016 - 2016)



Organizations Performing Work	Role	Type	Location
CU Aerospace, LLC	Lead Organization	Industry	Champaign, Illinois
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Illinois	Ohio

## Project Transitions

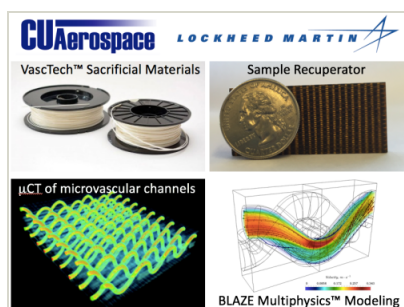
▶ **June 2016:** Project Start

✓ **December 2016:** Closed out

## Closeout Documentation:

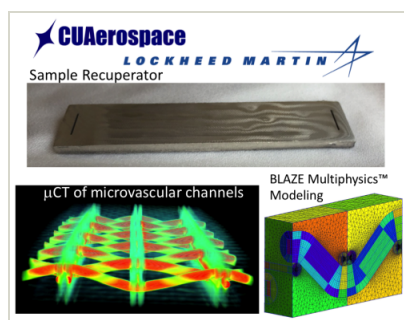
- Final Summary Chart(<https://techport.nasa.gov/file/139685>)

## Images



## Briefing Chart Image

Microcapillary Recuperative Heat Exchanger (MRHX), Phase I  
(<https://techport.nasa.gov/image/130097>)



## Final Summary Chart Image

Microcapillary Recuperative Heat Exchanger (MRHX), Phase I Project Image  
(<https://techport.nasa.gov/image/127224>)

## Organizational Responsibility

## Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

## Lead Organization:

CU Aerospace, LLC

## Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

## Program Director:

Jason L Kessler

## Program Manager:

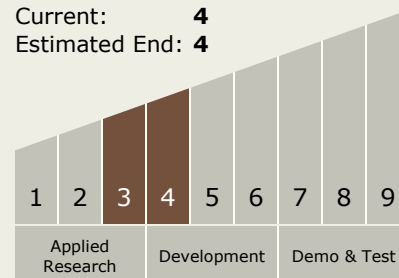
Carlos Torrez

## Principal Investigator:

Chris Mangun

## Technology Maturity (TRL)

Start: 3  
Current: 4  
Estimated End: 4



# Microcapillary Recuperative Heat Exchanger (MRHX), Phase I

Completed Technology Project (2016 - 2016)



## Technology Areas

### Primary:

- TX14 Thermal Management Systems
  - └ TX14.1 Cryogenic Systems
    - └ TX14.1.1 In-space Propellant Storage & Utilization

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System